TECHNICAL EDUCATION QUALITY IMPROVEMENT PROGRAMME (PHASE - II)

QUALITY CIRCLE AT IITs

MINISTRY OF HUMAN RESOURCE DEVELOPMENT

GOVERNMENT OF INDIA

SHASTRI BHAWAN, NEW DELHI

Quality Circle at IITs

Preamble: Technical education is the fastest growing academic discipline in India. A growing Indian economy demands more technical manpower and technology creators This requires an environment of innovation inspired by intellectual curiosity and driven by sound knowledge. The challenge of imparting high quality technical education to the increasing numbers of aspiring engineers requires creation of a formidable pantheon of enabled teachers – with intellectual capability, rigorous training and an exploratory frame of mind. Good teachers ensure the right ambience of enquiry, rigor and excitement in the class-rooms. A healthy academic environment is the prime-mover for creation of capable graduates, who can act as drivers of the growth story.

Technical education in India is provided by several players – IITs, NITs, State Colleges, deemed universities, aided and unaided private colleges. There are about 1200000 graduates each year, coming from about 3000 colleges. This means that roughly 480000 teachers are required (with a student to teacher ratio of 1:10). Clearly, with the indigenous population of graduates, the country is seriously wanting in this regard. Demanding a PhD as a minimum qualification for the teachers will be impossible, as the country does not produce even a fraction of the number of engineering PhDs. How do we solve the problem? Coupled with this shortage is the issue of quality of the education. The ideal attribute of a PhD being able to hold his own - in terms of teaching courses (in the area of specialization) in any Institute of repute, and directing their own independent research of the highest quality – are often not seen in many of the PhDs. An evolving educational paradigm requires teachers who have mastered their fields to the extent that the research can percolate down to the class-room.

Yet, technical education is plagued by lack of rigor and stress on fundamentals, and has (in many cases) degenerated into an exercise of rote and regurgitation – without developing the skills required for effective field/plant work or innovation and research. The curriculum seemingly has all the desired content, but suffers due to superficial and perfunctory attention to rigor. Fundamentals are sacrificed in favour of problem-solving and formula based learning, which restricts intellectual enquiry. The examination system also encourages rote learning and does not promote critical thinking. This is a serious waste of intellectual capacity.

In order to create a vibrant environment of academics, a paradigm shift in attitude and support has to be done. The primary goal should be to provide all the teachers (and aspiring ones) the right support to grow intellectually. This should be coupled with proper teaching tools and aids for effective teaching. This requires creation of a good platform for interaction, sharing of resources, intellectual discussion, continued learning, and knowledge improvement. Such a platform should provide access to the teachers and students (potential teachers of the future) to a window of interaction with the best brains in the country and outside. Forums for dialogue on content, new developments, new teaching paradigms, new thought processes, idea incubation and academic review can act as the catalyst for overall improvement of quality of technical education. Learning should become a continuous process. How do we create such a platform?

A proposal: The "Quality Circle at IITs [*Knowledge Incubation for TEQIP (KIT)*"

Vision: IITs are already involved in outreach activities, through Quality Improvement programme, i.e. Short courses; sponsored PhD programme; book-writing activities and workshops. This has a more national role and cannot cater to the specific requirements of TEQIP institutions in the local quality circle. Hence, it is envisaged that the Quality Circle (KIT) will serve the specific goal of quality improvement for the TEQIP institutions in the quality circle around an IIT.

The primary goal will be dissemination of knowledge (and know-how) to teachers, researchers and students through short-courses, workshops, seminars and thematic conference. Towards this end a facilitating cell will be set up. The cell will also engage in creating knowledge repositories through lectures for advanced courses by leading experts, compendium of projects, question bank, laboratory manuals and demonstrative experiments (for proof of concept), incorporation of new knowledge in the curriculum; open-source initiatives to create proper computational aids as national student initiatives/challenges; national student technological challenges and competitions – *derive, draw, drive* paradigm based. The centre will bring together the best minds in science and technology in India. It will yearn to increase interaction and partnership between the Indian intellectual pool and the international pool of expertise in the area. The centre will also serve to incubate new teaching and learning paradigms, and promote research in emerging areas of importance. The areas of interest that will be catered to are:

1) Mechanical sciences
2) Chemical sciences and materials
3) Electrical engineering and computer science
4) Physical sciences.

Planned activities:

The Quality Circle cell (KIT cell) will act as a nodal repository of emerging academic content, while initiating several activities for teacher training and knowledge enhancement of scholars The following levels of activities are envisaged:

(1) **Innovative content development**: The curriculum of all technical education institutions is extensive. However, the difference lies in the coverage of the stipulated material – both in terms of depth of coverage and quantity of material covered. Wide-variations exist in the delivery of the content. Uniform content of a given level of rigour, will be developed in the centre based on inputs from leading experts in the area from within and outside. The goal will be to create ideal course-files, lecture material, compendium of problems (relevant to the Indian context), desired practical projects to be associated with the courses, list of experiments for specific disciplines and level (core, departmental, undergraduate, post-graduate), laboratory manuals, template for laboratory reports, supplementary study material for laboratory courses, e-resource list to enhance the learning process (through specialized software, animations, experimentation platforms). The NPTEL resources will be taken and augmented.

The content development will require creation of small, focused work-groups with expertise drawn from within the Indian institutions and with advice from international experts, if necessary.

(2) **Text-books (electronic and paper format) development:** The centre will encourage and support writing of quality text-books, keeping in mind the Indian student, with possible translations into other Indian languages (to aid the English-challenged students). Leading experts within India will be invited to write the text-book material – with specified content and appropriate financial support from the centre. Solution manuals, for the aid of teachers will also be developed. Further, additional e-resources that may aid understanding of particular topics can also be developed. This will be a unique teaching resource development paradigm.

(3) **Design of experiments and set-ups:** Experimentation, and fear of hardware, is a bane for technical education in India. Not all experiments require costly equipment. Innovative, simple experimental set-ups will be developed with the help of leading experimentalists in IIT. Small kits to set up simple experiments will also be developed, for the student to assemble, and conduct the experiment. This should be able to take active experimentation to the remotest engineering class-room in the local quality circle. The basic idea is to ensure certain minimum standardized experiments to be mandatorily introduced in all the institutions in the local circle. These experiments will be geared to the learning needs of different levels of undergraduate classes and graduate students.

(4) **Teaching work-shops in specific cluster of courses:** There are several conferences to which teachers go to, to present their research. However, there is no platform where teachers can interact with faculty at IITs, and other leading institutions in India, and work out effective methods of teaching a subject. Such workshops will expose the teachers of this specific cluster of courses to fine-tune their teaching skills, clear fundamental doubts, develop new ways of looking at the subject, and possibly develop innovative new solutions to classical questions. Here, some leading authors in the specific areas will be called to share their understanding of the courses, participate in discussions and lead to enhancement of the teacher's knowledge of the subject. All this will percolate down to the class-room through more determined, informed and innovative delivery of the defined content. This will also make the courses more interesting for the students.

(5) **Short-courses and workshops in niche areas:** Periodically, short-courses in niche areas will be conducted to bring the latest in the field of engineering research to the teachers The short-courses will be conducted by leading international and Indian experts in the area. The course will be aimed at the teachers and PhD scholars in various technical institutions in the local circle and beyond. This will give the potential researchers an opportunity to interact with the experts, learn about the subject, and get a jump-start in research in these areas, if interested. This can also serve as a good

platform to bring people together, and should spawn new research collaborations. The courses can span four days to two-weeks.

(6) **Seminars:** Invited researchers and teachers will be invited to deliver seminars which will be web-cast to participating institutions.

(7) **Focused conferences in niche areas:** In order to promote a culture of research, and encourage aspiring researchers to take up specific emerging areas of importance, focused conferences in specific areas will be conducted. The idea is to keep the participation small and restricted to either persons working in the field or interested in taking up research in the area. Again, leading experts in the area will be invited to present talks at the conference. Usual talks and poster sessions will be organised to show-case the work of all the participants. The focused conferences will help bring established, renowned and aspiring researchers together. This will lead to new ideas, increased clarity of direction, effort to develop research activities in a focused way, and hence optimal usage of the resources. This will also lead to improvement of research quality.

(8) **Sabbatical/long-leave stay to teachers and researchers from TEQIP institutions:** The centre will also provide for a limited number of visiting scholars/researchers/teachers to spend time at IIT (under various TEQIP fellowship/scholarship schemes), either engaging in collaborative research or pursuing individual research or content development initiative.

(9) **Short-**term **visit of graduate students from TEQIP institutions,** for use of research facilities and conduct of specific research activity.

(10) **Reports:** The centre will bring out annual reports on activities of the centre, with articles on technical pedagogy, research papers, philosophical discussions on pedagogy and review/comments/suggestions on technical education in the local circle.

Support staff and administrative structure:

For efficient management and sustenance, a good administrative structure has to be put in place. The following structure is thought of:

(1) **Professor-in-charge:** The centres activities will be coordinated by a core committee with a retired faculty as the professor-in-charge. The retired faculty will be provided all extant benefits given to a professor in the HAG scale. The appointment will be initially till December , 2014 (i.e. TEQIP-II Project period) and may be for TEQIP-III as well.

(2) **The core-committee**: This will consist of 3 professors from IIT. The core team will be appointed initially till December, 2014 (i.e. TEQIP-II Project period). The professor-in-charge will make major administrative and policy decisions in consultation with the core committee.

(3) **Office in-charge**: A person of the rank of office superintendent will look after the office. The person should be well-versed in English language and should be computer-literate. The OIC will be responsible for keeping track of all current and future activities, liaison with the institute, get all the desired paper/office work done.

(4) **Computer engineer**: 1 project associates/assistants will be employed to maintain all the computer facilities, e-resources and web-casting facilities.

(5) **Office assistant**: 1 person to assist in filing, data entry, records upkeep and typing activities of the centre.

All workers will be hired in contractual mode, with salaries and perks as per existing norms, with continuation based on performance.

Duration:

For project period of TEQIP – II (i.e. December 2014) and may continue to provide resource support for TEQIP – III as well.

Administrative and infra-structural support from the IIT:

- Sanction of seminar rooms/class-rooms, along with multi-media facilities on request from professor in-charge/ signing authority of the centre.

- Hostel/guest-house rooms to visiting students/faculty during summers, winter-break and regular semesters against request from centre (payment for the same to be made by NPIU/student). For faculty a few SBRA/VFA may be made available, against request and payment by NPIU.

- Issue of temporary identity cards and access to library facilities, sports facilities, medical facilities and computer facilities against request (for each student/faculty a bill will be raised by the centre to NPIU for all the expenses to be incurred).

- Access to central laboratories/workshop to the visiting students and faculty, against request.

- If unavailable, temporary office space for visiting faculty.

CLARIFICATIONS

1. Academic training/workshop (programme fee) at DOPT rate of `7500 per participant per day which includes (course kit/case material/photocopy etc/certificate/group photo/folder/ dinner/food/cost of tuition/single room-per day-per person and Administrative expenses and Overheads).

2. Travel expenses will be borne by participants.

3. In addition to above (1&2) following is also available for FDP.

   Rs 2.00 Crore for Faculty Development Programme, broadly for (i) Resource persons both national and international (ii) management costs (iii) conferences/seminars/workshops (iv) teaching/learning materials and processes including ICT enabled learning, video conferencing facilities / corresponding ICT resources needed (v) Academic programmes inter alia faculty development programmes, remedial courses and joint research (if possible) (vi) Documentation (vii) Monitoring and Mentoring (viii) Contingencies/Travel etc.

Format for Estimate for release of Recurring Grant under Quality Circle (KIT):

Indicative Activities	Amount in `
Resource persons	
Teaching/learning materials	
ICT enabled learning, video conferencing facilities	
Research	
Activities related to Academic programmes inter alia faculty development programmes	
Documentation	
Mentoring	
Conferences/seminars/workshops etc.	
Travels	
Contingency etc	
Total	

Format for Estimate for release of Grant under Quality Circle (KIT) for programme fee:

Activity	Number of sessions planned	Duration of each Session	No. of Participants	Programme Fee @ ` 7500 per participants per day x (A*B*C)
	A	**B**	**C**	
Conclave				
Workshop				
Thematic Conference				
Quality Circle Review				
Expert Lectures				
Any others				
Total				